WHAT IS CLAIMED IS:

1. A method for converting video data format from interlaced scan rate to progressive scan rate, said method comprising of a perceptual model to determine membership probabilities of field samples (pixels) with regard to a plurality of image components of a field, said determination prioritizes the contributions from said image components, where the said image components are a static image component, a texture image component, and a motion image component.

2. The method of claim 1, where the interpolated samples of the final progressive frame is obtained by summing the modulated or adjusted versions of a plurality of image components.

3. The method of claim 2, where a current field, a past field and a future field are all partitioned into blocks of samples (pixels), and the image components are computed for samples of a block of the said current field based on block-based and sub-block-based perceptual parameters obtained from samples of the said current field, said past field, and said future field.

4. The method of claim 3, where adjustment of the static image component is comprised of reducing the said component by a modulated version of the said component, where the said modulation factor is Ra and is comprised of scaling an aed factor by BAI, the said aed is derived by computing the average energy of the difference between a block in future field and a prediction of the said block in past field, and further, the said BAI is obtained by computing the image difficulty of a block in current field.

5. The method of claim 4, where the modulation factor Ra *is* incremented by a term comprised of modulating Ra by a second modulation factor RSa, the said RSa is comprised of scaling an $aeds$ factor by $SVAI$, the said $aeds$ is derived by computing the average energy of the difference between a sub-block in future field and a prediction of the said sub-block in past field, the said sub-blocks being subset of blocks of claim 4 or have some overlapping pixels, and further, the said $SVAI$ *is* obtained by computing the average vertical image difficulty of the said sub-block in future field and a third sub-block in past

field, the third sub-block in past field having the same coordinates as the said sub-block in future field.

6. The method of claims 4 and 5 where both the block and sub-block predictions use the same motion information.

7. The method of claim 3, where the static image component is modulated by a factor *Rm,* said *Rm* is comprised of scaling the *aed* factor of claim 4 by *aed0* where the said *aed0 is* derived by computing the average energy of the difference between a block in future field and a corresponding block in past field, the said block in past field having the same coordinates as the said block in future field.

8. The method of claims 4, 5, 6 and 7 where the same process is used for texture image component.

9. The method of claims 2, 3, 4, 5, and 7, when the nominal values of *Ra* and *aed* are small, only contributions from static image component and motion image component are used.

10. The method of claim 9, when a small amount of motion for a block of samples is detected, the interpolated pixel is a sum of a modulated motion image component and an adjusted static image component, the said adjustment comprised of reducing the static image component by a modulated version of the static image component, the said modulation factor *is Ra* as described in claim 4.

11. The method of claim 9, when significant amount of motion for a block of samples is detected, the interpolated pixel is a sum of a modulated static image component and an adjusted motion image component, the said adjustment is comprised of reducing the motion image component by a modulated motion image component, the said modulating factor being *Rm,* the same as the modulating factor derived in claim 7 for the static image component.

12. The method of claim 3, where the static image component is modulated by a factor T1 , said T1 is comprised of adding an ascending term and a descending term, said

ascending term is further comprised of modulating Rm by an increasing function Af (Va), said Rm as described in claim 7, said increasing function increases as the amount of block motion Va increases, and the said descending term is comprised of modulating the adjustment factor $(1 - Ra)$ by a decreasing function Df $(V a)$, where the said Ra *is* described in claim 4, and the said decreasing function decreases as the amount of block motion Va increases.

13. The method of claims 10 and 12 with Ra being replaced by $Ra \times (1 + RSa)$, where RSa *is* described in claim 5.

14. The method of claims 9 and 12, when moderate amount of motion for a block of samples is detected, the interpolated pixel is sum of a modulated static image component and an adjusted motion image component, the said adjustment is comprised of reducing the motion image component by a modulated motion image component, the said modulating factors being Tl.

15. The method of claim 3, when the nominal values of Ra and aed are large, only contributions from texture image component and motion image component are used, the said values of Ra and aed are defined in claim 4.

16. The method of claim 15, when a small amount of motion for a block of samples is detected, the said block has a dominant texture image component.

17. The method of claim 16, where the interpolated pixel is a sum of a modulated motion image component and an adjusted texture image component, the said adjustment comprised of reducing the texture image component by a modulated version of the texture image component, the said modulation factors are $Ra \times (1 + RSa)$, where Ra *is* defined in claim 4 and RSa *is* defined in claim 5.

18. The method of claim 15, when significant amount of motion for a block of samples is detected, the interpolated pixel is a sum of a modulated texture image component and an adjusted motion image component, the said modulation factor is Rm as defined in claim 7, and further, the said adjustment is comprised of reducing the motion image component by a modulated motion image component, the said modulating factor being Rm.

19. The method of claim 15, where the texture image component is modulated by a factor Ts, said Ts is comprised of adding an ascending term and a descending term, said ascending term is defined in claim 12, and the said descending term is comprised of modulating the adjustment factor (1 - *Ra x (1 + RSa))* by a decreasing function *D f (V a),* where *D f (V a) is* described in claim 12 and *RSa is* defined in claim 5.

20. The method of claims 17 and 19 where factor *Ra x (1 + RSa) is* replaced by *Ra.*

21. The method of claims 15 and 19, when moderate amount of motion for a block of samples is detected, the interpolated pixel is sum of a modulated texture image component and an adjusted motion image component, the said modulating factor is Ts and further, the said adjustment is comprised of reducing the motion image component by a modulated motion image component, the said modulating factor being Ts.

22. The method of claim 3, when the nominal value of *Ra is* large and the nominal value of *aed is* small or when the nominal value of *Ra is* small and the nominal value of *aed is* large, the said values of *Ra* and *aed* as defined in claim 4, and further, the amount of motion is small for a block of samples, the interpolated pixel is sum of an adjusted spatial image component and a modulated motion image component, said adjustment is comprised of reducing the spatial image component by a modulated version of the spatial image component, said modulation factor is *Ra x (1+RSa),* said spatial image component is further comprised of summing an adjusted static image component and a modulated texture image component, said adjustment is comprised of reducing the static image component by a modulated version of the static image component, said modulation factor is *RSa,* the said *RSa is* defined in claim 5.

23. The method of claim 3, when the nominal value of *Ra is* large and the nominal value of *aed is* small or when the nominal value of *Ra is* small and the nominal value of *aed is* large, the said values of *Ra* and *aed* as defined in claim 4, and further, the amount of motion is significant for a block of samples, the interpolated pixel is sum of a modulated spatial image component and an adjusted motion image component, said adjustment is comprised of reducing the motion image component by a modulated version of the motion

image component, said modulation factor is *Rm,* said spatial image component is further comprised of summing an adjusted static image component and a modulated texture image component, said adjustment is comprised of reducing the static image component by a modulated version of the static image component, said modulation factor is *RSa,* the said *RSa is* defined in claim 5 and the said *Rm is* defined in claim 7.

24. The method of claim 3, when the nominal value of *Ra is* large and the nominal value of *aed is* small or when the nominal value of *Ra is* small and the nominal value of *aed is* large, the said values of *Ra* and *aed* as defined in claim 4, and further, the amount of motion is moderate for a block of samples, the interpolated pixel is sum of a modulated spatial image component and an adjusted motion image component, said adjustment is comprised of reducing the motion image component by a modulated version of the motion image component, said modulation factors are Ts, and further, the said spatial image component is sum of a modulated texture image component and an adjusted static image component, said adjustment is comprised of reducing the static image component by a modulated version of the static image component, said modulation factors are *RSa,* where the said Ts is defined in claim 19 and said *RSa is* defined in claim 5.

25. The method of claim 22 where *Ra x (1 + RSa) is* replaced by *Ra.*

26. The method of claim 24 where Ts is replaced by T1, said T1 is defined in claim 12.

27. The method of claim 3 where a ratio *Ro is* obtained for a block of current field, said ratio is comprised of adding vertical ratio *Rv* and horizontal ratio *Rh,* said vertical ratio is obtained from scaling a vertical block activity indicator by *BAI,* and further, said horizontal ratio is obtained from scaling a horizontal block activity indicator by BAI, where *BAI is* defined in claim 4.

28. The method of claim 27, when the magnitude of *Ro is* small for a block of samples in the current field, and further, the amount of motion is not small for the said block, the said block is declared to have moving edges.

29. The condition in claim 28 where only contributions from the texture image component and motion image component are used.

30. The method of claim 29, when significant amount of motion for a block of samples is detected, the interpolated pixel is a sum of a modulated texture image component and an adjusted motion image component, the said modulation factor is *Rm* as defined in claim 7, and further, the said adjustment is comprised of reducing the motion image component by a modulated version of the motion image component, the said modulating factor being *Rm*.

31. The method of claim 29, when moderate amount of motion for a block of samples is detected, the interpolated pixel is sum of a modulated texture image component and an adjusted motion image component, the said modulating factor is Ts, and further, the said adjustment is comprised of reducing the motion image component by a modulated version of the motion image component, the said modulating factor being Ts, said Ts is defined in claim 19.

32. The method in claim 31 where Ts is replaced by T1, said T1 is defined in claim 12.

33. The method of claim 1, where the perceptual model is assisted by a dual-stage motion compensation unit.

34. A method for converting video data from interlaced format to progressive format, comprising:

determining a probability of a first image component of a field, wherein the determination assigns a priority to the first image component; and

determining a probability of a second image component of a field, where the determination assigns a priority to the second image component.

35. The method as recited in claim 34, further comprising:

modulating a first image component to produce a first modulated image component;

modulating a second image component to produce a second modulated image component;

summing the first modulated image component and the second modulated image component; and

producing a progressive frame based on the sum of the first modulated image component and the second modulated image component.

36. The method as recited in claim 34, further comprising:

partitioning a first field to produce a first block of samples;

partitioning a second field to produce a second block of samples;

determining a first image component for the first block of samples; and

determining a second image component based on the second block of samples.

37. The method as recited in claim 36, further including:

modulating the first image component based on an average energy (“*aed”*) of a difference between a block in a future field and a prediction of the block in a past field scaled by an image difficulty of a block *(“BAI”)* in the current field.

38. The method of claim 37, further comprising:

computing the average energy of the differences between a sub-block in a future field and a prediction of the sub-block in a past field;

computing the average vertical image difficulty of the sub-block in the future field and the sub-block in past field, the sub-block in past field having the same coordinates as the sub-block in future field;

modulating the first image component based on the average energy of the differences between a sub-block in the future field and a prediction of the sub-block in a past field; and

modulating the first image component based on the average vertical image difficulty of the sub-block in the future field and the sub-block in past field, the sub-block in past field having the same coordinates as the sub-block in future field.

39. The method of claim 37, further comprising:

predicting a block based upon a first set of motion information; and

predicting a sub-block based on the first set of motion information.

40. The method of claim 36, further including:

computing the average energy (*"aed0"*) of the difference between a block in a future field and a block in a past field, the block in the future field having a first set of coordinates, the block in the past field having a second set of coordinates, wherein the first set of coordinates and the second set of coordinates are substantially equal; and

modulating the first image component based on the average energy of the difference between the block in the future field and the block in the past field.

41. The method as recited in claim 36, further including:

modulating the second image component based on an average energy (*"aed"*) of a difference between a block in a future field and a prediction of the block in a past field scaled by an image difficulty of a block *("BAI")* in the current field.

42. The method of claim 41, further including:

scaling *aed* by BAI to produce a modulation factor ("Ra"); and

if Ra and *aed* are larger than a threshold value, further including;

modulating the second image component based on an average energy (*"aed"*) of a difference between a block in a future field and a prediction of the block in a past field scaled by an image difficulty of a block *("BAI")* in the current field.

43. The method as recited in claim 42, further comprising:

computing a motion for a block of samples, wherein an interpolated pixel is produced if the motion of a block of samples is less than a threshold value;

modulating a first image component;

adjusting a second image component; and

summing the modulated first motion image component and the adjusted second image component to produce an interpolated pixel.

44. The method of claim 42, further comprising:

computing the amount of motion for a block of samples, wherein if the amount of motion for the block of samples is greater than a threshold value, an interpolated pixel is produced;

modulating a first image component;

adjusting a second image component, further including;

reducing a second image component by a factor, wherein the factor ("Rm") is computed by scaling *aed* by *aed0*.

45. The method as recited in claim 36, further comprising:

modulating the first image component, including:

summing an ascending term, including

increasing a first modulation factor by a function increasing as the motion of the block increases; and

summing a descending term, including:

decreasing a second modulation factor by a function decreasing as the motion of the block increases.

46. A computer program product for converting video data from interlaced format to progressive format, comprising:

a set of instructions configured to determine a probability of a first image component of a field, wherein the determination assigns a priority to the first image component; and

a set of instructions configured to determine a probability of a second image component of a field, where the determination assigns a priority to the second image component.

47. The computer program product as recited in claim 46, further comprising:

a set of instructions configured to modulate a first image component to produce a first modulated image component;

a set of instructions configured to modulate a second image component to produce a second modulated image component;

a set of instructions configured to produce a progressive frame based on the sum of the first modulated image component and the second modulated image component.

48. The computer program product as recited in claim 46, further comprising:
a set of instructions configured to partition a first field to produce a first block of samples;
a set of instructions configured to partition a second field to produce a second block of samples;
a set of instructions configured to determine a first image component for the first block of samples; and
a set of instructions configured to determine a second image component based on the second block of samples.

49. The computer program product as recited in claim 48, further comprising:
a set of instructions configured to modulate the first image component based on an average energy ("*aed*") of a difference between a block in a future field and a prediction of the block in a past field scaled by an image difficulty of a block *("BAI")* in the current field.

50. The computer program product as recited in claim 49, further comprising:
a set of instructions configured to compute the average energy of the differences between a sub-block in a future field and a prediction of the sub-block in a past field;
a set of instructions configured to compute the average vertical image difficulty of the sub-block in the future field and the sub-block in past field, the sub-block in past field having the same coordinates as the sub-block in future field;
a set of instructions configured to modulate the first image component based on the average energy of the differences between a sub-block in the future field and a prediction of the sub-block in a past field; and
a set of instructions configured to modulate the first image component based on the average vertical image difficulty of the sub-block in the future field and the sub-block in past field, the sub-block in past field having the same coordinates as the sub-block in future field.

51. The computer program product as recited in claim 49, further comprising:
a set of instructions configured to predict a block based upon a first set of motion information; and
a set of instructions configured to predict a sub-block based on the first set of motion information.

52. The computer program product as recited in claim 48, further comprising:
a set of instructions configured to compute the average energy (“*aed0*”) of the difference between a block in a first field and a block in a second field, the block in the first field having a first set of coordinates, the block in the second field having a second set of coordinates, wherein the first set of coordinates and the second set of coordinates are substantially equal; and
a set of instructions configured to modulate the first image component based on the average energy of the difference between the block in the first field and the block in the second field.

53. The computer program product as recited in claim 48, further comprising:
a set of instructions configured to modulate the second image component based on an average energy (“*aed*”) of a difference between a block in a future field and a prediction of the block in a past field scaled by an image difficulty of a block *(“BAI”)* in the current field.

54. The computer program product as recited in claim 53, further comprising:
a set of instructions configured to scale *aed* by BAI to produce a modulation factor (also referred to as Ra); and
a set of instructions configured to determine if Ra and *aed* are larger than a threshold value; and,
a set of instructions configured, if Ra and *aed* are greater than a threshold value, to modulate the second image component based on an average energy (“*aed*”) of a difference between a block in a future field and a prediction of the block in a past field scaled by an image difficulty of a block *(“BAI”)* in a current field.

55. The computer program product as recited in claim 54, further comprising:
a set of instructions configured to compute a motion for a block of samples, wherein an interpolated pixel is produced if the motion of a block of samples is less than a threshold value;
modulating a first image component;
adjusting a second image component; and
summing the modulated first image component and the adjusted second image component to produce an interpolated pixel.

56. The computer program product as recited in claim 54, further comprising:
a set of instructions configured to compute the amount of motion for a block of samples, wherein if the amount of motion for the block of samples is greater than a threshold value, an interpolated pixel is produced;
a set of instructions configured to modulate a first image component;
a set of instructions configured to adjust a second image component, further comprising:
a set of instructions configured to reduce a second image component by a factor, wherein the factor (also referred to as "Rm") is computed by scaling *aed* by *aed0*.

57. The computer program product as recited in claim 48, further comprising:
a set of instructions configured to modulate the first image component, further comprising:
a set of instructions configured to sum an ascending term, including increasing a first modulation factor by a function increasing as the motion of the block increases; and
a set of instructions configured to sum a descending term, including: decreasing a second modulation factor by a function decreasing as the motion of the block increases.

58. A set-top box for de-interlacing video data from interlaced format to progressive format, comprising:
a processor,
a memory operably coupled to the processor;

means to determine a probability of a first image component of a field, wherein the determination assigns a priority to first image component; and

means to determine a probability of a second image component of a field, where the determination assigns a priority to the second image component.

59. The set-top box as recited in claim 58, further comprising:

means to modulate a first image component to produce a first modulated image component;

means to modulate a second image component to produce a second modulated image component;

means to sum the first modulated image component and the second modulated image component; and

means to produce a progressive frame based on the sum of the first modulated image component and the second modulated image component.

60. The set-top box as recited in claim 58, further comprising:

means to partition a first field to produce a first block of samples;

means to partition a second field to produce a second block of samples;

means to determine a first image component for the first block of samples; and

means to determine a second image component based on the second block of samples.

61. The set-top box as recited in claim 59, further comprising:

means to modulate the first image component based on an average energy (*"aed"*) of a difference between a block in a future field and a prediction of the block in a past field scaled by an image difficulty of a block *("BAI")* in the current field.

62. The set-top box as recited in claim 61, further comprising:

means to compute the average energy of the differences between a sub-block in a future field and a prediction of the sub-block in a past field;

means to compute the average vertical image difficulty of the sub-block in the future field and the sub-block in past field, the sub-block in past field having the same coordinates as the sub-block in future field;

means to modulate the first image component based on the average energy of the

differences between a sub-block in the future field and a prediction of the sub-block in a past field; and

means to modulate the first image component based on the average vertical image difficulty of the sub-block in the future field and the sub-block in past field, the sub-block in past field having the same coordinates as the sub-block in future field.

63. The set-top box as recited in claim 61, further comprising:

means to predict a block based upon a first set of motion information; and

means to predict a sub-block based on the first set of motion information.

64. The set-top box as recited in claim 60, further comprising:

means to compute the average energy (also referred to as *aed0*) of the difference between a block in a future field and a block in a past field, the block in the future field having a first set of coordinates, the block in the past field having a second set of coordinates, wherein the first set of coordinates and the second set of coordinates are substantially equal; and

means to modulate the first image component based on the average energy of the difference between the block in the future field and the block in the past field.

65. The set-top box as recited in claim 60, further comprising:

means to modulate the second image component based an average energy ("*aed*") of a difference between a block in a future field and a prediction of the block in a past field scaled by an image difficulty of a block *("BAI")* in the current field.

66. The method of claim 62, further comprising:

means to scale *aed* by BAI to produce a modulation factor (also referred to as Ra); and

means to determine if Ra and *aed* are larger than a threshold value, and if Ra and *aed* are larger than the threshold value, modulate a second image component based on an average energy ("*aed*") of a difference between a block in a future field and a prediction of the block in a past field scaled by an image difficulty of a block *("BAI")* in the current field.

67. The set-top box as recited in claim 66, further comprising:
means to compute a motion for a block of samples, wherein an interpolated pixel is produced if the motion of a block of samples is less than a threshold value;
means to modulate a first image component;
means to adjust the second image component; and
means to sum the modulated first image component and the adjusted second image component to produce an interpolated pixel.

68. The set-top box as recited in claim 66, further comprising:
means to compute the amount of motion for a block of samples, wherein if the amount of motion for the block of samples is greater than a threshold value, an interpolated pixel is produced;
means to modulate a first image component;
means to adjust a second image component, further comprising:
means to reduce the second image component by a factor, wherein the factor (also referred to as "Rm") is computed by scaling *aed* by *aed0*.

69. The set-top box as recited in claim 60, further comprising:
means to modulate the first image component, further comprising:
means to sum an ascending term, comprising:
means to increase a first modulation factor by a function increasing as the motion of the block increases; and
means to sum a descending term, comprising:
decreasing a second modulation factor by a function decreasing as the motion of the block increases.